

Store Separation Analysis



Store Separation Analysis

The mission of the Store Separation Competency is to predict and expand the regions of safe separation and jettison of all Navy aircraft/store (weapon, missile, target, UAV, sensor pod, etc.) configurations. This function is performed using validated store separation prediction codes which integrate CFD or wind tunnel data to predict store trajectories after release. Flight test data is used to improve the codes predictive performance before predicting the next test point. The competency includes skills pertaining to aerodynamic analysis, aerodynamic load and flow field prediction, six degree-of-freedom dynamic trajectory analysis, specialized aircraft/store wind tunnel and flight testing techniques, and the correlation and normalization of the accumulated information.

Store Separation Analysis



Store Separation Analysis: The most critical feature that determines a store's separation trajectory are the carriage moments, which are principally caused by the aircraft flowfield. For this reason, the first step in separation analysis is to estimate the region of the flight envelope that might have the worst carriage moments. This is done by deriving an estimate of the aircraft flowfield. The primary analytical tools for this purpose used by NAWCAD to evaluate the aircraft aerodynamics are potential flow techniques (PAN AIR, TranAir) that have been validated for most of the current Navy aircraft.

After determining the aircraft flowfield, the Influence Function Method (IFM) is used to determine the effect of the aircraft flowfield on the store loads and moments. NAWCAD is recognized as an international authority on the IFM method. Using the aircraft flowfield and store influence coefficients, an estimate of store aerodynamic coefficients is made everywhere in the flowfield, including

carriage. The store aerodynamic coefficients are then input in a six-degree-of-freedom program to simulate the store's trajectory. When wind tunnel results become available, simulation results are compared to the analytical predictions to identify any discrepancies. Sensitivity studies are conducted based on the wind tunnel results to determine the regions of the flight envelope where problems in launching or jettisoning the store might be encountered.

Finally, trajectory simulations are compared with the flight test results early in the flight test program. Any discrepancy between predictions and test data, assuming that the store mass properties and freestream aerodynamics were properly modeled, can be largely attributed to differences between the assumed and actual carriage aerodynamic moments. It is thus possible to update the carriage models before predicting the trajectories at the next test point. This allows a much more accurate simulation of the trajectories in the critical regions of

the flight envelope for safe flight clearance limits.

The bulk of the store trajectory analyses are performed on Silicon Graphics workstations in the Flight Dynamics Computer Laboratory. However, the simulation codes are flexible and transportable on laptop computers. As a result, the wind tunnel data can be fed directly into the simulation code on site at the test to help develop additional test requirements.

For more information about Store Separation Analysis, contact the Naval Aviation Systems Team at Patuxent River, MD, 301-342-8554 or DSN 342-8554.